Geometry Honors
Reflections on the Coordinate Plane   Name ______________________

Part I:
On a sheet of graph paper, plot polygon ABCD
with A (0,0) , B (4, -5), C (6,0), D (3,5).

1. Reflect ABCD over the x axis: and give the coordinates of the image points (A' is the image of A).

A ' = _____, B' = ______, C' = _______, D' = _______

B) Find a rule for reflection of (x,y) over the x axis (r_x (x,y)). r_x (x,y) = ____________

2. Reflect ABCD over the y axis and give the coordinates of the image points (A" is the image of A).

A" = ________, B" = __________, C" = _________, D" = _________

B) Find a rule for r_y (x,y). r_y(x,y) = ______________

3. Reflect ABCD over the line y = x and give the coordinates of the image points.

A) A"' = ________, B "' = _________, C "" = _________, D"" = _______

B) Find a rule for $r_{y=x}$(x,y). $r_{y=x}$ (x,y) = ____________

4. Reflect ABCD over the line y = -x.

A) A""= ___________, B""= ___________, C""= _________, D""= ________

B) Find a rule for $r_{y=-x}$(x,y). $r_{y=-x}$(x,y) = _____________

GENERAL QUESTION: How is the reflection line related to the segment connecting a preimage point to its image point?

Part II:
Reflect the graphs of each of the following lines as indicated. Find the equation of the image of each line. See how you can use your rules to find the equations of the images. Answer the "general question" for each.

1. $y = 3x + 2$, r_x

2. $y = \frac{-2}{3}x - 1$, r_y

3. $y = \frac{1}{2}x + 3$, $r_{y=x}$

4. $y = 3x + 2$, $r_{y=-x}$

5. $y = -3x - 1$, r_x

6. $y = \frac{1}{2}x + 3$, r_y

At what point does the pre-image coincide with the image?

Part III:

1. Reflect each line in #1 - 3 over the line $y = 3$.
Find the equation of each image.
Can you find a rule for this transformation?

At what point does the preimage coincide with the image?

2. Reflect each line in #1 - 3 over the line $x = 5$. Find the equation of each image.
Can you find a rule for this transformation?

At what point does the preimage coincide with the image?

3. Reflect each line in #1 - 3 over the line $y = x + 2$. Find the equation of each image.
Can you find a rule for this transformation?

At what point does the preimage coincide with the image?

4. Reflect each line in #1 - 3 over the line $y = x - 2$. Find the equation of each image.
Can you find a rule for this transformation?

At what point does the preimage coincide with the image?

Geometry Honors
Translations on the Coordinate Plane   Name ___________________________

I. On a sheet of graph paper, plot polygon ABCD
with A (0,0) , B (4, -5), C (6,0), D (3,5).

1. A) Translate ABCD 4 units right and 2 units down and give the coordinates of the image points.

A ' = _____, B' = ______, C' = _______, D' = _______

B) Find a rule for the translation of (x,y) over the x axis ($T_{4,-2}$ (x,y)).

$T_{4,-2}$ (x,y) → ____________

2. A) Translate ABCD 3 units left and 1 unit up and give the coordinates of the image points (A" is the image of A).

A" = ________, B" = _________, C" = _________, D" = _________

B) Find a rule for $T_{-2,1}$ (x,y). $T_{-2,1}$ (x,y) → ________________

Complete the general rule for translation of a point, $T_{a,b}$.

$T_{a,b}(x,y) \rightarrow$ ______________________.

In a translation does the preimage ever coincide with the image?

In a translation does the orientation of the figure change?

Is a translation an isometry? Why or why not?

Translations on the Coordinate Plane

Part II:

Translate the graphs of each of the following lines as indicated. (Use graph paper.) Find the equation of the image of each line. See if you can formulate a rule to find the equations of the images.

1. $y = 3x + 2$, $T_{3,2}$

2. $y = \frac{-2}{3}x - 1$, $T_{-2,1}$

3. $y = \frac{1}{2}x + 3$, $T_{2,-1}$

4. $y = 3x + 2$, $T_{-3,-2}$

5. $y = -3x - 1$, $T_{2,-1}$

6. $y = \frac{1}{2}x + 3$, $T_{-2,1}$

Geometry Honors
Rotations

The symbol for a rotation transformation is R with a subscript indicating the degree of the rotation. Unless otherwise indicated, all rotations are counterclockwise and the center of the rotation is the origin.

Rotate each of the following points as indicated:

(x_o, y_o)	R_{90}	R_{180}	R_{270}
(2,0)			
(0,3)			
(-2,1)			
(1,-2)			
(3,5)			
(-3,5)			
(3,-5)			
(-3,-5)			
(x_o, y_o)			

Rotate each of the following lines as indicated. Write the equation of the image line. Make a note of how the slopes of the preimage line and image line are related.
Determine the point of intersection of the perpendicular bisectors of the segment connecting each preimage point to its image point.
Try to determine the rule for writing the equation of y = mx + b for each of the three rotations in the chart. When you are sure of the rule, continue graphing to check your results.

1. $y = 3x + 2,\ R_{90}$

2. $y = \frac{-2}{3}x - 1, R_{180}$

3. $y = \frac{1}{2}x + 3, R_{270}$

4. $y = 3x + 2,\ R_{180}$

5. $y = \frac{-2}{3}x - 1, R_{90}$

6. $y = \frac{1}{2}x + 3, R_{90}$

7. $y = 3x + 2,\ R_{270}$

8. $y = \frac{1}{2}x + 3, R_{180}$

Geometry Honors
Transformations on the coordinate plane

Name ______________________________

Transform each of the following as indicated:
a) Graph the original and the image at each stage of the transformations
b) Algebraically find the equation of the image line at each stage of the transformations
c) Determine the one-step rule for the complete transformation: Original to final image

1. $y = \frac{2}{3}x - 3$ First: $T_{1,-2}$, then r_x

2. $y = 2x + 1$ First R_{90}, then R_{180}

3. $y = \frac{1}{4}x + 2$ First $T_{3,5}$, then $T_{1,-4}$

4. $3y = 4x + 6$ r_x, then $r_{y=x}$

5. $y = -3x + 2$ R_{-90}, then R_{180}

6. $2x + y = 6$ $r_{y=x}$, then $r_{y=-x}$

Compositions:

If you transform a figure by a Reflection over the x axis and then transform that image over the y axis, the composite transformation is written:

$$r_y \circ r_x.$$

This is read "reflection over the y axis FOLLOWING a reflection over the x axis.

Some composites result in a single transformation that can be easily identified an described. Describe each of the following composites as a single transformation:

1. $r_y \circ r_x$
2. $R_{90} \circ R_{180}$
3. $r_x \circ r_{y=x}$
4. $r_{y=-x} \circ r_y$
5. $R_{270} \circ R_{-180}$
6. $T_{4,-3} \circ T_{-2,8}$
7. R_{60}^3
8. R_{45}^2
9. $r_{y=x}^3$
10. $T_{3,-2}^4$

(NOTE: Magnitude is the degree measure of a rotation).

Fill in the blanks:

1. The composite of 2 reflections over perpendicular lines is a ______________ with magnitude equal to ________.

2. The composite of two reflections over lines that intersect at a 45 degree angle is a __________________ with magnitude equal to ________.

3. The composite of two reflections over lines that intersect at an x degree angle is a __________________ with magnitude equal to ________.

4. The composite of two rotations is a ___________________ with magnitude equal to ________.

5. The composite of two translations is a __________________ with the rule: ______________

Geometry Honors
Dilations

A dilation is a transformation that may stretch or shrink the preimage; in either case, both the x and y coordinate of each preimage point is multiplied by the same factor.

A scale change is a transformation in the x and y coordinate of the preimage points are multiplied by different factors; it is a distortion.

Our symbol for dilation will be $D_{center,factor}$. Our symbol for a scale change will be $S_{a,b}$ where the center of the dilation will be the origin and the x-coordinate will be multiplied by a and the y-coordinate will be multiplied by b.

I. Graph the following polygon and perform the indicated transformation:

A(0,0); B (4,0), C (4,2)

1. $D_{O,2}$ 2. $D_{O,\frac{1}{2}}$ 3. $S_{2,3}$ 4. $S_{\frac{1}{2},3}$

II. For each of the following.

a. Graph the line given and its image under the indicated transformations.
b. For each transformations, find the equation of the image line.
c. Try to determine a rule for finding the equation of the image line without graphing.

1. $y = 2x$ A. $D_{O,2}$ B. $D_{O,4}$ C. $D_{0,\frac{1}{2}}$ D. $D_{O,-3}$

2. $y = 3x$ A. $S_{2,1}$ B. $S_{1,3}$ C. $S_{2,3}$ D. $S_{\frac{1}{4},1}$

3. $y = 3x + 1$ A. $D_{O,2}$ B. $S_{1,3}$ C. $S_{2,3}$ D. $S_{1,\frac{1}{2}}$

4. $y = 2x - 2$ A. $D_{O,-2}$ B. $S_{1,-2}$ C. $S_{-3,1}$ D. $S_{-2,-3}$

III. Test your rule on the following: (Check by graphing)

1. $y = -3x + 5$ $D_{0,-2}$ 2. $y=\frac{1}{2}x + 4$ $D_{0,\frac{2}{3}}$